

Application No. 09/889,862
Filed: July 23, 2001
Group Art Unit: 1733

REMARKS

Claims 1, 9, 11, 12, 19, and 20 have been rejected under 35 U.S.C. § 102(b) over Olry et al. '217. Reconsideration and withdrawal of this rejection is respectfully requested for the following reasons.

The present invention relates to a method of manufacturing a bowl of thermostructural composite material. Claim 1 recites, among other things, the steps of providing deformable two-dimensional fiber plies and deforming the plies so that they fit closely on the former by deforming without forming folds. Dependent claim 20 recites that the fiber plies are used whole, being free from any cutouts or slots, thereby obtaining a preform for a complete bowl in one piece.

As discussed in the Background of the Invention, known prior art bowls for use in producing single silicon crystals are made of C/C composite material. Techniques presently in use for making such bowls include making a preform by superposing layers or plies of two-dimensional fiber fabric on a former matching the shape of the preform to be made (specification, page 3, lines 27-29). However, for bowl-shaped pieces, it is difficult to make a fiber preform having the right shape (specification, page 4, lines 16-

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19). As stated in the specification (page 4, line 26, to page 5, line 2):

The technique of draping plies is also difficult to implement for shapes that are this complex when it is desired to avoid forming extra thickness due to folds in the plies. A known solution consists in cutting the plies, in particular to form slots, as a function of the shape that is to be made so that the plies can fit closely on this shape with the lips of the cutouts or slots coming together once draped and shaped. Such plies must be precut with very great precision. Cut plies also present the drawback of leaving discontinuities in the yarns of the preform.

The present invention overcomes these difficulties by providing deformable two-dimensional fiber plies and deforming the plies so that they fit closely on the former by deforming without forming folds.

To anticipate a claim, a reference must anticipate every element of the claim, either expressly or inherently. If not disclosed expressly, the claimed element must necessarily be present in the reference, as recognized by those of skill in the art. It is not sufficient that a reference might disclose a claimed element.

Olry '217 is silent as to the recited step of deforming the plies so that the plies fit closely on the former by deforming without forming folds. There is, furthermore, nothing in Olry '217 or elsewhere to suggest that the plies in Olry are necessarily

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deformed without forming folds. Accordingly, the rejection of claim 1 by Olry under § 102(b) is not believed to be proper and reconsideration and withdrawal is respectfully requested.

Regarding claim 9, Olry is silent as to use of carbon fiber yarns free of surface functions. There is no evidence that one of skill in the art would recognize that Olry necessarily utilizes carbon fiber yarns free of surface functions. Thus, this claim is believed to be patentable for this reason as well.

Dependent claim 19 recites that the preform is densified by chemical vapor infiltration. The Examiner cites Olry for teaching chemical vapor deposition. Thus, claim 19 is believed to be patentable for this reason as well.

Dependent claim 20 is similarly believed to be patentable over Olry. There is no evidence that Olry necessarily utilizes whole fiber plies free from cutouts or slots. Olry at most mentions that the shape of support tooling 10 is intended to constitute the front portion or nose of a space aircraft (col. 3, lines 61-62). There is no mention of a single piece nose cone. Thus, this claim is believed to be patentable as well.

Claims 1, 9-13, 16-20, 25, 26, and 44 have been rejected under § 103(a) over Walsh in view of Olry et al. '217. These

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claims are believed to be patentable for the reasons set forth above with regard to Olry '217.

In addition, reconsideration of the combination of Walsh in view of Olry is also requested for the following reasons. Walsh discloses only a two-part crucible holder including a crucible holder top 3 and a crucible holder bottom 13, as illustrated in Fig. 2. The use of multi-part crucible holders is one of the fundamental issues of the prior art that the presently claimed invention is meant to avoid. Moreover, Walsh specifically relates to the use of three-dimensional carbon-carbon composites (see, for example, col. 2, lines 47-50), as opposed to two-dimensional fiber plies, as in the present invention. In fact, Walsh recognizes the distinction between three-dimensional and two-dimensional composites (col. 2, lines 10-14). Thus, modifying Walsh to use two-dimensional plies would be contrary to the intended purpose of Walsh, i.e., providing furnace hardware from three-dimensional composite materials (col. 2, lines 47-50). Thus, such a modification would be improper under § 103.

The Examiner's asserted motivation for applying Olry's teachings to Walsh is that Olry's preform manufacturing techniques would allow one to manufacture a bowl shaped perform easily. However, Olry's disclosure relating to two-dimensional fiber plies

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is not applicable to Walsh's three-dimensional composites. Accordingly, claim 1 is believed to be patentable over Walsh in view of Olry '217.

Regarding claim 10, the Examiner asserts that use of carbon fiber yarns provided with an interphase coating of pyrolytic carbon in the operation of Walsh would be within the purview of the ordinary artisan. Applicants respectfully traverse this assertion. The use of such carbon fiber yarns is not of such "notorious character." (MPEP § 2144.03) There must be evidence of a motivation to use such carbon fiber yarns, which is absent in the present case. Similarly, regarding claims 13 and 44, there is no indication that the transferred fiber density is a known parameter in the art.

Accordingly, claims 1, 9-13, 16-20, 25, 26, and 44 are believed to be patentable over Walsh in view of Olry '217.

Claims 2, 3, 5-7, 14, 15, 42, 43, and 48-50 have been rejected under § 103(a) over Walsh in view of Olry '217 and further in view of Monget et al. and Cahuzac. These claims are believed to be patentable for the reasons set forth above with respect to Walsh and Olry '217.

In addition, the prior art of record does not disclose or suggest the use of deformable individual mesh loops, as in claim

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2, or the use of needling with such loops, as in claims 5 and 42. Similarly, the prior art of record does not disclose or suggest that the plies are angularly offset about a central axis of the bowl, as in claims 7 and 48.

Claims 4, 8, and 41 have been rejected under § 103(a) over Walsh in view of Olry '217, Monget et al., and Cahuzac, and further in view of Olry et al. '348. These claims are believed to be patentable for the reasons set forth above with respect to Walsh and Olry '217.

Additionally, the prior art of record does not disclose or suggest plies formed by knitting, as in claim 8. Note that 'Olry 348 discloses bonding of plies by knitting, not forming plies by knitting.

Claims 21-24, 28, 29, and 45 have been rejected under § 103(a) over Walsh in view of Olry '217 and further in view of EP 913,504 and Soviet Union Patent 1699755. These claims are believed to be patentable for the reasons set forth above with respect to Walsh and Olry '217.

Furthermore, claim 21 recites that plies having no cutouts or slots are used, followed by forming a hole in the bottom of the preform. The references offer no motivation or suggestion to form the hole prior to densification using chemical vapor infiltration,

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at least 4
greater than
less than

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or to plug the hole after densification. Also, the Soviet Union reference is not believed to be relevant, because it relates to the repair of a graphite crucible, not to a bowl made from fiber plies. Also, assertion that the SU patent teaches that the plugs are made from graphite is not clear; arguably, the abstract can equally be interpreted to state that the plugs 4, 5 are each made from the same, unspecified, material.

This combination of references also does not disclose, teach, or suggest forming the requisite hole by aligning respective holes formed in the plies, as recited in claim 22.

Claims 23 and 45 recite that the plug is made from a thermostructural composite material, which is defined on page 1 of Applicants' specification as a material comprising fiber reinforcement made of refractory fibers. As noted above, the SU patent does not disclose that the material of the plugs 4, 5 is a thermostructural material as claimed.

Regarding claim 24, these references do not disclose, teach or suggest performing an additional chemical vapor infiltration process after putting the claimed plug into place.

Claim 27 has been rejected under § 103(a) over Walsh in view of Olry '217 in view of EP 913,504 and further in view of any one of Metter et al., Kondo et al., or Holcombe et al. This claim is

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believed to be patentable for the reasons set forth above with respect to Walsh and Olry '217.

Claims 51 and 52 have been rejected under § 103(a) over Walsh in view of Olry '217, Monget et al., and Cahuzac, and further in view of EP 913,504 and Soviet Union Patent 1699755. These claims are believed to be patentable for the reasons set forth above with respect to Walsh and Olry '217, as well as for the reasons set forth with respect to EP 913,504 and SU 1699755.

In view of the above amendments and remarks, all claims are believed to be in condition for allowance, and reconsideration and indication thereof are respectfully requested. The Examiner is encouraged to telephone the undersigned attorney to discuss any matter that would expedite prosecution of the present application.

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